1. TITLE OF THE INVENTION

COMMUNICATION APPARATUS AND METHOD OF OPERATING COMMUNICATION APPARATUS

2. BACKGROUND OF THE INVENTION

(a)Field of the Invention

The present invention relates to a communication apparatus including several kinds of coding methods or decoding methods and a method of operating the same.

(b)Description of the Related Art

As a method for switching a coding method during communication with the other communicating party, following method are known, for example: A first method performs switching after sending a switching request. A second method performs switching after receiving a response for a switching request.

However, in the first method, since, during a period from a time when a communication apparatus at the sending side switches a coding method to a time when a communication apparatus at the receiving side switches a decoding method, the communication apparatus at the receiving side decodes audio and/or video data coded in the coding method after

switched by using a decoding method corresponding to the coding method before switched, problems regarding the occurrence of noise and/or turbulence of video are raised.

On the other hand, in the second method, during the period from a time when a communication apparatus at the receiving side switches a decoding method to a time when a communication apparatus at the sending side switches a coding method, since the receiving communication apparatus decodes audio and/or video data coded in a coding method before switched by using a decoding method corresponding to a coding method after switched, problems regarding the occurrence of noise and/or turbulence of video are raised.

Thus, recently, for example, a method is proposed that an audio and/or video data is muted for a certain period of time when a coding method is switched and then the audio and/or video data is output gradually in order to suppress the occurrence of noise and/or turbulence of video. However, in this method, the occurrence of noise can be suppressed, but another problem is raised that voice and/or video are interrupted.

Further, among coding methods or decoding methods, there exists a method that feeds back past information for coding or decoding. In this method, if a coding method or a decoding method is switched before coding processing or decoding processing become stable, problems regarding the

occurrence of noise and/or turbulence of video are raised.

3. SUMMARY OF THE INVENTION

An object of the present invention is to solve the above-described problems. As one preferred embodiment under such a object, a communication apparatus of the present invention includes a first coding unit for creating a first coded data including audio signals coded by using a first coding method, a second coding unit for creating a second coded data including audio signals coded by using a second coding method that is different from the first coding method, and a sending unit for sending at least one of the first coded data and the second coded data. In this case, the sending unit sends the first coded data and the second coded data when a coding method is switched from the first coding method to the second coding method during communication with the other communicating party.

Also, as another embodiment, a method of operating a communication apparatus of the present invention includes a first coding step for creating first coded data including audio signals coded by using a first coding method, a second coding step for creating second coded data including audio signals coded by using a second coding method that is different from the first coding method, and a sending step

for sending at least one of the first coded data and the second coded data. In this case, the sending step sends the first coded data and the second coded data when a coding method is switched from the first coding method to the second coding method during communication with the other communicating party.

Further, as another embodiment, a communication apparatus of the present invention includes a receiving unit for sending at least one of first coded data including audio signals coded by using a first coding method and second data including audio signals coded by using a second coding method that is different from the first coding method, a first decoding unit for decoding the first coding method, a second decoding unit for the second coded data, and an output unit for outputting either one of audio signals output from the first decoding unit and audio signals output from the second decoding unit. In this case, wherein the receiving unit receives the first coded data and the second coded data when a coding method is switched from the first coding method to the second coding method during communication with the other communicating party.

Furthermore, as another embodiment, a method of operating a communication apparatus of the present invention includes a receiving step for receiving at least one of first coded data including audio signals coded by using a

first coding method and second data including audio signals coded by using a second coding method that is different from the first coding method, a first decoding step for decoding the first coding method, a second decoding step for decoding the second coded data, and an output step for outputting either one of audio signals output from the first decoding unit and audio signals output from the second decoding unit. In this case, the receiving step receives the first coded data and the second coded data when a coding method is switched from the first coding method to the second coding method during communication with the other communicating party.

Still other objects of the present invention, and the advantages thereof, will become fully apparent from the following detailed description of the embodiments.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing a main construction of a packet communication apparatus (sending side) according to a first embodiment of the present invention;

Fig. 2 is a block diagram showing a main construction of a packet communication apparatus (receiving side) according to the first embodiment of the present invention;

Fig. 3 is a diagram for describing one example of main

processing steps of a packet communication apparatus according to the first embodiment of the present invention;

Fig. 4 is a diagram for describing another example of main processing steps of a packet communication apparatus according to the first embodiment of the present invention;

Fig. 5 is a flowchart for describing main processing steps of a packet communication apparatus according to the first embodiment of the present invention;

Fig. 6 is a flowchart for describing main processing steps of a packet communication apparatus according to the first embodiment of the present invention;

Fig. 7 is a flowchart for describing main processing steps of a packet communication apparatus according to the first embodiment of the present invention;

Fig. 8 is a diagram showing a construction of a data packet according to the first embodiment of the present invention;

Fig. 9 is a diagram showing a construction of a data packet according to a second embodiment of the present invention;

Fig. 10 is a diagram showing an example of main processing steps of a packet communication apparatus according to the second embodiment of the present invention; and

Fig. 11 is a diagram showing another example of main

processing steps of a packet communication apparatus according to the second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will now be described in detail hereinafter with reference to the accompanying drawings.

Embodiment 1

Fig. 1 is a block diagram showing one construction example of a packet communication apparatus (sending side) according to a first embodiment of the present invention.

Fig. 1 includes a packet communication apparatus (sending side) 100 according to a first embodiment, an audio processing apparatus 101, a packet network 112, and an image processing apparatus 113. The audio processing apparatus 101 includes a microphone or a voice playback apparatus, for example, and outputs analog audio signals in a predetermined audio format. The packet network 112 includes a Local Area Network (LAN), a Wide Area Network (WAN), Internet, a satellite communication line, a serial bus or wireless LAN compliant with the IEEE1394-1995 standard, for example. The image processing apparatus 113 includes a video camera or a video playback apparatus and outputs analog video signals in

a predetermined video format. The audio processing apparatus 101 and/or the image processing apparatus 113 may be within the packet communication apparatus 100, for example.

Further, Fig. 1 includes an input portion 102, a select portion 103, and a control portion 109. The input portion 102 converts analog audio signals output from the audio processing apparatus 101 to digital audio signals and/or analog video signals output from the video processing apparatus 113 to digital video signals. The select portion 103 supplies audio and/or video signals output from the input portion 102 to at least one coding portion 104-i (i = 1 to N (N is an integer of 2 or above)) in accordance with an instruction from the control portion 109.

Each coding portion 104-i (i = 1 to N) codes audio or/and video signals having a same content by using a coding method each has. An audio coding method that each coding portion 104-i (i = 1 to N) has may be Moving Picture Experts Group (MPEG) 1 audio method compliant with the ISO/IEC 13818-3 standard, Adaptive Differential PCM (ADPCM) method, Sub-band ADPCM (SB-ADPCM) method, or Low-Delay Code Excited Linear Prediction(LD-CELP) method, for example. Further, a video coding method that each coding portion 104-i (i = 1 to N) includes may be the MPEG 1 method compliant with the ISO/IEC11172-2 standard or the MPEG 2 method compliant with

the ISO/IEC 13818-2 standard, for example. It should be noted that the combination of the audio coding method and video coding method that each coding portion 104-i (i = 1 to N) has differs for every coding portion 104-i (i = 1 to N).

Further, Fig. 1 includes a select portion 105, a communication portion 106, an operating portion 114, and a timer 115. The select portion 105 supplies coded data output from at least one coding portion 104-i (i = 1 to N) in accordance with an instruction from a control portion 109.

The communication portion 106 creates a data packet including coded data output from the select portion 105 and sends the created data packet to the other packet communication apparatus. Further, the communication portion 106 creates a control packet including control data (switching request, switching response, switching confirmation, for example, described below) output from the control portion 109 and sends the created control packet to the other packet communication apparatus. Furthermore, the communication apparatus 106 receives a control packet sent from the other packet communication apparatus and supplies control data (switching request, switching response, switching confirmation, for example, described below) included in the received control packet to the control portion 109. The communication portion 106 includes a LAN controller, a Transmission Control Protocol/Internet

Protocol (TCP/IP) Protocol stack, a serial bus controller or a wireless LAN controller, for example.

The control portion 109 controls an operation of the packet communication apparatus 100 (sending side) by following processing steps described below. It should be noted that the control portion 109 includes a microcomputer, a memory and different kinds of control programs). The operating portion 114 displays a currently selected coding method, displays a selectable coding method, or inquires of a user about a coding method after switched. The timer 115 measures a time that is enough for processing steps of the switched coding method to be stable.

Fig. 2 is a block diagram showing one construction example of a packet communication apparatus (receiving side) according to the first embodiment of the present invention.

Fig. 2 includes a packet communication apparatus (receiving side) 200, an audio processing apparatus 201, and an image processing apparatus 213. The audio processing apparatus 201 includes a speaker or an audio recording apparatus. The image processing apparatus 213 includes a video recording apparatus or a display apparatus such as a CRT, a liquid crystal panel, and a plasma display panel. The audio processing apparatus 201 and/or the image processing apparatus 213 may be within the packet

communication apparatus 200.

Further, the packet communication apparatus 200 includes a communication portion 206, a select portion 205, and a control portion 209. The communication portion 206 receives a data packet sent from the other packet communication apparatus and supplies coded data included in the received data packet to the select portion 205. Further, the communication portion 206 receives a control packet sent from the other packet communication apparatus and supplies control data (switching request, switching response, switching confirmation, for example, described below) included in the received control packet to the control portion 209. Further, the communication portion 206 creates a control packet including the control data (switching request, switching response, switching confirmation, for example, described below) supplied from the control portion 209 and sends the created control packet to the other packet communication apparatus. The communication portion 206 includes a LAN controller, a Transmission Control Protocol/Internet Protocol (TCP/IP) Protocol stack, a serial bus controller or a wireless LAN controller, for example.

The select portion 205 supplies coded data output from the communication portion 206 to at least one decoding portion 204-i (i = 1 to N (N is an integer of 2 or above)) in accordance with an instruction from the control portion

209.

Each decoding portion 204-i (i = 1 to N) decodes audio or/and video signals having a same content by using a decoding method each has. An audio decoding method that each decoding portion 204-i (i= 1 to N) includes corresponds to an audio coding method that each coding portion 104-i (i - 1 to N) includes. Further, a video coding method that each decoding portion 204-i (i = 1 to N) includes corresponds to a video coding method that each coding portion 104-i (i = 1 to N) includes. It should be noted that the combination of the audio decoding method and video decoding method that each decoding portion 204-i (i - 1 to N) has differs for every decoding portion 204-i (i = 1 to N).

The select portion 203 supplies audio and/or video signals output from at least one decoding portion 204-i (i = 1 to N) to an output 202 in accordance with an instruction from the control portion 209.

The output portion 202 converts digital audio signals output from the select portion 203 to analog audio signals and supplies the converted analog audio signals to the audio processing apparatus 201.

The output portion 202 converts digital video signals output from the select portion 203 to analog video signals and supplies the converted analog video signals to the video processing apparatus 213.

The control portion 209 controls an operation of the packet communication apparatus 200 (receiving side) by following processing steps described below. It should be noted that the control portion 209 includes a microcomputer, a memory and different kinds of control programs. The operating portion 214 displays a currently selected coding method, displays a selectable coding method, or inquires of a user about a coding method after switched. The timer 215 measures a time that is enough for processing steps of the switched coding method to be stable.

Next, by referring to Fig. 8, a construction of a data packet according to a first embodiment of the present invention will be described.

As shown in Fig. 8, a data packet 800 according to the first embodiment includes a header 801, coding method information 802, coded data 803, and footer 804. The header 801 includes information for identifying the other communicating party, for example. The coding method information 802 includes information indicating a coding method for the coded data 803 and a decoding method corresponding thereto. The coded data 803 includes audio and/or video signals coded by using a coding method before switched (a first coding method that a first coding portion 104-1 includes). The footer 804 includes information for detecting or correcting an error occurred in a data packet,

for example.

Further, as shown in Fig. 8, a data packet 810 according to the first embodiment includes a header 811, coding method information 812, coded data 813 and a footer 814. The header 811 includes information for identifying the other communicating party, for example. The coding method information 812 includes information indicating a decoding method for the coded data 813 and a decoding method corresponding thereto. The coded data 813 includes audio and/or video signals coded by using a coding method after switched (a second coding method that a second coding portion 104-2 includes). The footer 814 includes information for detecting or correcting an error occurred in a data packet, for example.

Next, by referring to Fig. 3, it will be described one example of main processing steps of packet communication apparatuses 100 and 200 according to the first embodiment. In Fig. 3, it will be described processing steps in a case where, during communication with the packet communication apparatus 200 (receiving side), the packet communication apparatus 100 (sending side) requests switching of a coding method. Further, in Fig. 3, a case will be described where the coding method before switched is a first coding method that a first coding portion 104-1 includes, for example, while the coding method after switched is a second coding

method that a second coding portion 104-2 includes, for example.

First of all, a processing step of a step S301 will be described. The input portion 102 converts analog audio signals output from the audio processing apparatus 101 to digital audio signals. Also, the input portion 102 converts the analog video signals output from the video processing apparatus 113 to digital video signals. The select portion 103 supplies audio and/or video signals output from the input portion 102 to the first coding portion 104-1. The first coding portion 104-1 codes the audio and/or video signals supplied from the select portion 103 and creates coded data 803, sequentially. The select portion 105 supplies the coded data 803 output from the first coding portion 104-1. The communication portion 106 creates a data packet 800 including the coded data 803 sequentially, and sends it to the packet communication apparatus 200 sequentially.

The communication portion 206 sequentially receives the data packet 800 sent from the packet communication apparatus 100 and supplies coding method information 802 to the control portion 209. The control portion 209 determines a coding method for the coded data 803 and a decoding method corresponding thereto based on the coding method information 802. The select portion 205 sequentially supplies the coded

data 803 to the first decoding portion 204-1. The first decoding portion 204-1 decodes the coded data 803 by using a first decoding method corresponding to the first coding method and creates audio and/or video signals. The select portion 203 supplies audio and/or video signals output from the first decoding portion 204-1 to the output portion 202. The output portion 202 converts the digital audio signals from the select portion 203 to the analog audio signals or digital video signals from the select portion 203 to the analog video signals. Then, The output portion 202 supplies the analog audio signals to the audio processing apparatus 201 and/or the analog video signals to the video processing apparatus 213.

Next, a processing step of a step S302 will be described. the control portion 109 determines whether or not the coding method needs to be switched from the first coding method to the second coding method. For example, when the control portion 109 detects a change in traffic in the packet network 112 and automatically determines that the coding methods needs to be changed from the first method to the second method, the control portion 109 switches the coding method from the first coding method to the second coding method. Further, when a user manipulates the operating portion 114 in order to instruct to change the coding method from the first coding method to the second

coding method, for example, the control portion 109 switches the coding method from the first coding method to the second coding method. When the coding method is switched from the first coding method to the second coding method, the control portion 109 starts preparation for coding audio and/or video signals having a same content by using a coding method before switched and a coding method after switched. The timer 115 starts measuring a predetermined time T1 (a time enough for the operation by the coding portion 104-2 to be stable) in accordance with an instruction from the control portion 109. The select portion 103 supplies the audio and/or video signals having a same content to the first coding portion 104-1 and the second coding portion 104-2 in accordance with an instruction from the control portion 109. The select portion 105 supplies the coded data 803 output from the first coding portion 104-1 to the communication 106 in accordance with an instruction from the control portion 109. However, the select portion 105 does not supply the coded data 813 output from the second coding portion 104-2 to the communication portion 106. It should be noted that, until the predetermined time T1 passes (a time enough for the operation of the second coding portion 104-2 to be stable), the coded data 813 output from the second coding portion 104-2 is prevented from being supplied to the communication portion 106.

Next, a processing step of a step S303 will be described. After the predetermined time T1 has passed (that is, after the coding processing of the second coding portion 104-2 has become stable), the control portion 109 supplies control data for requesting switching of the coding method (called switching response below) to the communication portion 106. The communication portion 106 creates a control packet including a switching request and sends this to the packet communication apparatus 200.

The communication apparatus 206 receives a control packet (including the switching request) sent from the packet communication apparatus 100. The control portion 209 starts preparation for switching the coding method from the first coding method to the second coding method after receiving the switching request. Further, the timer 215 starts measuring a predetermined time T2 (a time enough for an operation of the second decoding portion 204-2 to be stable) in accordance with an instruction from the control portion 209.

Next, a processing step of a step S304 will be described. The select portion 105 supplies to the communication portion 106 the coded data 803 output from the first coding portion 104-1 and the coded data 813 output from the second coding portion 104-2 in accordance with the control portion 109. The communication portion 106 creates

a data packet 800 including the coded data 803 and a data packet 810 including the coded data 813 sequentially and sends them to the packet communication apparatus 200 sequentially. It should be noted that the communication portion 106 starts sending the data packet 800 and the data packet 810 without connecting a new call with the packet communication apparatus 200.

The communication portion 206 sequentially receives the data packet 800 and the data packet 810 sent from the packet communication apparatus 100 and supplies the coded data 803 and the coded data 813 to the select portion 205 and the coding method information 802 and 812 to the control portion 209. The control portion 209 determines a coding method for the coded data 803 and a decoding method corresponding thereto based on the coding method information 802 and determines a coding method for the coded data 813 and a decoding method corresponding thereto based on the coding method information 812. The select portion 205 supplies the coded data 803 to the first decoding portion 204-1 and coded data 813 to the second decoding portion 204-2 in accordance with an instruction from the control portion 209. The select portion 203 supplies audio and/or video signals output from the first decoding portion 204-1 to the output portion 202 in accordance with an instruction from the control portion 209. However, the audio and/or video

signals output from the second decoding portion 204-2 is prevented from being supplied to the output portion 202. The select portion 203 does not supply audio and/or video signals output from the second decoding portion 204-2 until the predetermined time T2 (a time enough for an operation of the second decoding portion 204-2 to be stable) has passed.

Next, a processing step of a step S305 will be described. After the predetermined time T2 has passed (that is, after the decoding processing by the second decoding portion 204-2 gets stable), the select portion 203 supplies audio and/or video signals output from the second decoding portion 204-2 to the output portion 202 in accordance with an instruction from the control portion 209. However, audio and/or video signals output from the first decoding portion 204-1 is prevented from being supplied to the output portion 202. The output portion 202 converts digital audio signals from the select portion 203 to analog audio signals and the digital video signals from the select portion 203 to the analog video signals. Then, the output portion 202 supplies the analog audio signals to the audio output apparatus 201 and analog video signals to the video apparatus 213. Further, the control portion 209 supplies control data corresponding to a switching request (called "switching response" below) to the communication portion 206. The communication portion 206 creates a control packet including

the switching response and then sends it to the packet communication apparatus 100.

The communication portion 106 receives the control packet (including the switching response) sent from the packet communication apparatus 200. The control portion 109 receives the switching response and then terminates processing for coding audio and/or video signals by using the first coding method.

Next, a processing step of a step S306 will be described. The control portion 109 receives the switching response and then supplies a switching confirmation to the communication portion 106. The communication portion 106 creates a control packet including the switching confirmation and then sends it to the packet communication apparatus 200.

Next, a processing step of a step S307 will be described. The select portion 103 supplies audio and/or video signals output from the input portion 102 to the second coding portion 104-2 but not to the first coding portion 104-1 in accordance with an instruction from the control portion 109. Further, the select portion 105 supplies coded data 813 output from the second coding portion 104-2 to the communication portion 106 in accordance with an instruction from the control portion 109. The communication portion 106 sequentially creates a data packet

810 including the coded data 813 and sequentially sends it to the packet communication apparatus 200. Since the packet communication apparatus 200 switches the coding method from the first coding method to the second coding method, the data packet 810 sent from the packet communication apparatus 100 can be decoded without any problems, which also can prevent the occurrence of noise, video turbulence and/or audio and/or video interruption.

Next, by referring to Fig. 4, another example of main processing steps by the packet communication apparatuses 100 and 200 according to the first embodiment will be described. In Fig. 4, during communication with the packet communication apparatus 100 (sending side), it will be described processing steps where the packet communication apparatus 200 (receiving side) requests for switching a coding method. Further, in Fig. 4, like the description on Fig. 3, it will be described a case where it is assumed that the coding method before switched is a first coding method included by the first coding portion 104-1, for example, and the coding method after switched is a second coding method included by the second coding method, for example.

First of all, a processing step of a step S401 will be described. In the processing step at the step S401 is the same as the processing step at the step S301, and the description will be omitted here.

Next, a processing step of a step S 402 will be described. The control portion 209 determines whether or not the coding method must be switched from the first coding method to the second coding method. For example, when the control portion 209 detects a change in traffic in the packet network 112 and automatically determines that the coding method must be changed from the first coding method to the second coding method, the control portion 209 switches the coding method from the first coding method to the second coding method. Further, when a user manipulates the operating portion 214 to change the coding method from the first coding method to the second coding method, the control portion 209 switches the coding method from the first coding method to the second coding method. When the coding method has been switched from the first coding method to the second coding method, the control portion 209 supplies control data for requesting switching of the coding method (called "switching request" below) to the communication portion 206. The communication portion 206 creates a control packet including the switching request and then sends it to the packet communication apparatus 100.

The communication portion 106 receives the control packet (including the switching request) sent from the packet communication apparatus 200. After receiving the switching request, the control portion 109 starts

preparation for coding audio and/or video signals having a same content by using the first and second coding methods. Further, the timer 115 starts measuring a predetermined time T1 (a time enough for the operation of the second coding portion 104-2 to be stable) in accordance with an instruction from the control portion 109. The select portion 103 supplies the audio and/or video signals having a same content to the first coding portion 104-1 and the second coding portion 104-2 in accordance with an instruction from the control portion 109. The select portion 105 supplies coded data 803 from the first coding portion 104-1 to the communication portion 106 in accordance with an instruction from the control portion 109 but prevents coded data 813 output from the second coding portion 104-2 to be supplied to the communication portion 106. It should be noted that, until the predetermined time T1 passes (a time enough for the operation of the second coding portion 104-2 to be stable), the coded data 813 output from the second coding portion 104-2 is prevented from being supplied to the communication portion 106.

Next, a processing step of a step S403 will be described. After the predetermined time T1 has passed (that is, after the coding processing of the second coding portion 104-2 has become stable), the control portion 109 supplies a switching response to the communication portion 106. The

communication portion 106 creates a control packet including the switching response and sends this to the packet communication apparatus 200.

The communication portion 206 receives the control packet (including the switching response) sent from the packet communication apparatus 100. The control portion 209 starts preparation for switching the coding method from the first coding method to the second coding method after receiving the switching response. Further, the timer 215 starts measuring a predetermined time T2 (a time enough for an operation of the second decoding portion 204-2 to be stable) in accordance with an instruction from the control portion 209.

Next, a processing step of a step S404 will be described. The select portion 105 supplies to the communication portion 106 the coded data 803 output from the first coding portion 104-1 and the coded data 813 output from the second coding portion 104-2 in accordance with the control portion 109. The communication portion 106 creates a data packet 800 including the coded data 803 and a data packet 810 including the coded data 813 sequentially and sends them to the packet communication apparatus 200 sequentially. It should be noted that the communication portion 106 starts sending the data packet 800 and the data packet 810 without connecting a new call with the packet

communication apparatus 200.

The communication portion 206 sequentially receives the data packet 800 and the data packet 810 sent from the packet communication apparatus 100 and supplies the coded data 803 and the coded data 813 to the select portion 205 and the coding method information 802 and 812 to the control portion 209. The control portion 209 determines a coding method for the coded data 803 and a decoding method corresponding thereto based on the coding method information 802 and determines a coding method for the coded data 813 and a decoding method corresponding thereto based on the coding method information 812. The select portion 205 supplies the coded data 803 to the first decoding portion 204-1 and coded data 813 to the second decoding portion 204-2 in accordance with an instruction from the control portion 209. The select portion 203 supplies audio and/or video signals output from the first decoding portion 204-1 to the output portion 202 in accordance with an instruction from the control portion 209. However, the audio and/or video signals output from the second decoding portion 204-2 is prevented from being supplied to the output portion 202. The select portion 203 does not supply audio and/or video signals output from the second decoding portion 204-2 until the predetermined time T2 (a time enough for an operation of the second decoding portion 204-2 to be stable) has passed.

Next, a processing step of a step S405 will be described. After the predetermined time T2 has passed (that is, after the decoding processing by the second decoding portion 204-2 gets stabilized), the select portion 203 supplies audio and/or video signals output from the second decoding portion 204-2 to the output portion 202 in accordance with an instruction from the control portion 209. However, audio and/or video signals output from the first decoding portion 204-1 is prevented from being supplied to the output portion 202. The output portion 202 converts digital audio signals from the select portion 203 to analog audio signals and the digital video signals from the select portion 203 to the analog video signals. Then, the output portion 202 supplies the analog audio signals to the audio output apparatus 201 and analog video signals to the video apparatus 213. Further, the control portion 209 supplies a switching confirmation to the communication portion 206. The communication portion 206 creates a control packet including the switching confirmation and then sends it to the packet communication apparatus 100.

The communication portion 106 receives the control packet (including the switching confirmation) sent from the packet communication apparatus 200 and supplies the switching confirmation included in the control packet to the control portion 109. The control portion 109 receives the

switching confirmation and then terminates processing for coding audio and/or video signals by using the first coding method.

Next, a processing step of a step S406 will be described. The select portion 103 supplies audio and/or video signals output from the input portion 102 to the second coding portion 104-2 but not to the first coding portion 104-1 in accordance with an instruction from the control portion 109. Further, the select portion 105 supplies coded data 813 output from the second coding portion 104-2 to the communication portion 106 in accordance with an instruction from the control portion 109. The communication portion 106 sequentially creates a data packet 810 including the coded data 813 and sequentially sends it to the packet communication apparatus 200. Since the packet communication apparatus 200 switches the coding method from the first coding method to the second coding method, the data packet 810 sent from the packet communication apparatus 100 can be decoded without any problems, which also can prevent the occurrence of noise, video turbulence and/or audio and/or video interruption.

Next, a main processing step of the packet communication apparatus 100 (sending side) according to the first embodiment will be described by referring to the flowchart in Fig. 5.

In a step S501, the control portion 109 determines whether or not the coding method must be switched from the first coding method to the second coding method. When the coding method is switched, the flowchart goes to a step S503. On the other hand, when the coding method is not switched, the flowchart goes to a step S502.

In the step S502, the control portion 109 determines whether or not a control packet including a switching request has been received or not. When the switching request has been received, the flowchart goes to a step S504. On the other hand, when the switching request has not been received, the flowchart goes to a step S501.

Next, a processing step of a step S503 in Fig. 5 will be described by referring to a flowchart in Fig. 6.

In a step S601, the control portion 109 starts preparation for coding audio and/or video signals having a same content by using a coding method before switched and a coding method after switched.

In a step S602, the control portion 109 determines whether or not a predetermined time T1 (a time enough for the coding processing by the coding portion 104-2 to be stable) has passed. If the predetermined time has passed, the flowchart goes to a step S603.

In the step S603, the control portion 109 supplies a switching request to the communication portion 106. the

communication portion 106 creates a control packet including the switching request and the sends it to the packet communication apparatus 200. After sending the switching request, the communication portion 106 starts sending audio and/or video signals coded by using the coding method before switched and audio/video signals coded by using the coding method after switched.

In a step S604, the control portion 109 determines whether or not the control packet including a switching response could be received within a predetermined time. If the switching response could be received, the flowchart goes to a step S606. On the other hand, if the switching request could not be received, the flowchart goes to a step S605.

In the step S605, the control portion 109 controls the audio and/or video signals coded by using the coding method before switched to be sent to the packet communication apparatus 200. Further, the control portion 109 controls the audio/video signals coded by using the coding method after switched not to be sent to the packet communication apparatus 200.

In the step S606, the control portion 109 controls the audio and/or video signals coded by using the coding method before switched not to be sent to the packet communication apparatus 200. Further, the control portion 109 controls the audio and/or video signals coded after switched to be

sent to the packet communication apparatus 200.

In a step S607, the control portion 109 supplies a switching confirmation to the communication portion 106. The communication portion 106 creates a control packet including the switching confirmation and then sends it to the packet communication apparatus 200.

Next, a processing step of a step S504 in Fig. 5 will be described by referring to a flowchart in Fig. 7.

In a step S701, the control portion 109 starts preparation for coding audio and/or video signals having a same content by using a coding method before switched and a coding method after switched.

In a step S702, the control portion 109 determines whether or not a predetermined time T1 (a time enough for a coding process by the coding portion 104-2 to be stable) has passed. If the predetermined time has passed, the flowchart goes to a step S703.

In the step S703, the control portion 109 supplies a switching response to the communication portion 106. The communication portion 106 creates a control packet including the switching response and then sends it to the communication apparatus 200. After sending the switching response, the communication portion 106 starts sending audio and/or video signals coded by the coding method before switched and audio and/or video signals coded by using the

coding method after switched.

In a step S704, the control portion 109 determines whether or not the control packet including a switching confirmation could be received within a predetermined time. If the switching confirmation could be received, the flowchart goes to a step S706. On the other hand, if the switching confirmation could not be received, the flowchart goes to a step S705.

In the step S705, the control portion 109 controls the audio and/or video signals coded by using the coding method before switched to be sent to the packet communication apparatus 200. Further the control portion 109 controls the audio/video signals coded by using the coding method after switched not to be sent to the packet communication apparatus 200.

In the step S706, the control portion 109 controls the audio and/or video signals coded by using the coding method before switched not to be sent to the packet communication apparatus 200. Further the control portion 109 controls the audio and/or video signals coded by using the coding method after received to be sent to the packet communication apparatus 200.

As described above, according to the first embodiment, even when a coding method is switched during communication with the other party, the occurrence of noise, turbulence of

video, interruption of audio and/or video could be prevented.

Further, according to the first embodiment, the audio and/or video signals coded by using a coding method after switched is not sent until a coding process gets stable. Thus, even when a coding method feeding back past information is switched, the occurrence of noise, turbulence of video, interruption of audio and/or video could be prevented.

Furthermore, according to the first embodiment, audio and/or video signals coded by using a coding method after switched can be sent without connecting a new call, which eliminates a need for complicated communication processes. Thus, the communication efficiency can be improved.

Embodiment 2

In the first embodiment, a case has been described where audio and/or video signals coded by using a coding method before switched and audio and/or video signals coded by using a coding method after switched are packetized to separate data packets.

On the other hand, in a second embodiment, a case will be described where audio and/or video signals coded by using a coding method before switched and audio and/or video signals coded by using a coding method after switched are packetized to a same data packet.

Next, a construction of data packet according to the second embodiment will be described by referring to Fig. 9.

As shown in Fig. 9, a data packet 900 according to the second embodiment includes a header 901, coding method information 802, coded data 803, coding method information 812, coded data 813 and a footer 904. The header 901 includes information for identifying the other communicating party, for example. The coding method information 802 includes information indicating a coding method for the coded data 803 and a decoding method corresponding thereto. The coded data 803 includes audio and/or video signals coded by using a coding method before switched (a first coding method that a first coding portion 104-1 includes, for example). The coding method information 812 includes information indicating a coding method for coded data 813 and a decoding method corresponding thereto. the coded data 813 includes audio and/or video signals coded by using a coding method after switched (a second coding method that a second coding portion 104-2 includes, for example). The footer 904 includes information for detecting or correcting an error occurred in a data packet, for example.

Next, by referring to Fig. 10, it will be described one example of main processing steps of packet communication apparatuses 100 and 200 according to the second embodiment. In Fig. 10, it will be described processing steps in a case

where, during communication with the packet communication apparatus 200 (receiving side), the packet communication apparatus 100 (sending side) requests switching of a coding method. Further, in Fig. 10, it is assumed that the coding method before switched is a first coding method that a first coding portion 104-1 includes, for example, while it is assumed that the coding method after switched is a second coding method that a second coding portion 104-2 includes, for example. It should be noted that processing steps will be described in detail which are different from the processing steps shown in Fig. 3, and the same reference numerals will be given to the processing steps that are similar to those in Fig. 3 and the description thereof will be omitted here.

A processing step of a step S1001 will be described. The select portion 105 supplies coded data 803 output from the first coding portion 104-1 and coded data 813 output from the second coding portion 104-2 to the communication portion 106 in accordance with an instruction from the control portion 109. The communication portion 106 creates a data packet 900 including the coded data 803 and the coded data 813 sequentially, and sends them to the packet communication apparatus 200 sequentially. The communication portion 106 starts sending the data packet 900 without connecting a new call with the packet communication

apparatus 200.

The communication portion 206 sequentially receives the data packet 900 sent from the packet communication apparatus 100 and supplies coded data 803 and coded data 813 to the select portion 205 and coding method information 802 and 812 to the control portion 209. The control portion 209 determines a coding method for the coded data 803 and a decoding method corresponding thereto based on the coding method information 802. The select portion 205 supplies the coded data 803 to the first decoding portion 204-1 and supplies the coded data 813 to the second decoding portion 204-2 in accordance with an instruction from the control portion 209. The select portion 203 supplies audio and/or video signals output from the first decoding portion 204-1 to the output portion 202 but does not supply audio and/or video signals output from the second decoding portion 204-2 to the output portion 202 in accordance with an instruction from the control portion 209. The select portion 203 does not supply audio and/or video signals output from the second decoding portion 204-2 to the output portion 202 until a predetermined time T2 (a time enough for an operation of the second decoding portion 204-2 to be stable) has passed.

Next, by referring to Fig. 11, it will be described another example of main processing steps of packet communication apparatuses 100 and 200 according to the

second embodiment. In Fig. 11, it will be described processing steps in a case where, during communication with the packet communication 100 (sending side), the packet communication apparatus 200 (receiving side) requests switching of a coding method. Further, in Fig. 11, in the same manner as the description for Fig. 10, it is assumed that the coding method before switched is a first coding method that a first coding portion 104-1 includes, for example, while it is assumed that the coding method after switched is a second coding method that a second coding portion 104-2 includes, for example. It should be noted that processing steps will be described in detail in Fig. 11, which are different from the processing steps shown in Fig. 4, and the same reference numerals will be given to the processing steps that are similar to those in Fig. 4 and the description thereof will be omitted here.

A processing step of a step S1101 will be described. The select portion 105 supplies coded data 803 output from the first coding portion 104-1 and coded data 813 output from the second coding portion 104-2 to the communication portion 106 in accordance with an instruction from the control portion 109. The communication portion 106 creates a data packet 900 including the coded data 803 and the coded data 813 sequentially, and sends them to the packet communication apparatus 200 sequentially. The communication

portion 106 starts sending the data packet 900 without connecting a new call with the packet communication apparatus 200.

The communication portion 206 sequentially receives the data packet 900 sent from the packet communication apparatus 100 and supplies coded data 803 and coded data 813 to the select portion 205 and coding method information 802 and 813 to the control portion 209. The control portion 209 determines a coding method for the coded data 803 and a decoding method corresponding thereto based on the coding method information 802. The select portion 205 supplies the coded data 803 to the first decoding portion 204-1 and supplies the coded data 813 to the second decoding portion 204-2 in accordance with an instruction from the control portion 209. The select portion 203 supplies audio and/or video signals output from the first decoding portion 204-1 to the output portion 202 but does not supply audio and/or video signals output from the second decoding portion 204-1 to the output portion 202 in accordance with an instruction from the control portion 209. The select portion 203 does not supply audio and/or video signals output from the second decoding portion 204-2 to the output portion 202 until a predetermined time T2 (a time enough for an operation of the second decoding portion 204-2 to be stable) has passed.

As described above, according to the second embodiment,

like the first embodiment, even when a coding method is switched during communication with the other party, the occurrence of noise, turbulence of video, interruption of audio and/or video could be prevented.

Further, according to the second embodiment, audio and/or video signals coded by a coding method before switched and audio and/or video signals coded by a coding method after switched can be packetized in a same data packet. Thus, the communication efficient can be improved more than that in the first embodiment.

Further, according to the second embodiment, like the first embodiment, the coding decoding method is not switched until a decoding process of a decoding method after switched gets stable. Thus, even when the decoding method after switched is a decoding method feeding back past information, the occurrence of noise, turbulence of video, interruption of audio and/or video could be prevented.

Furthermore, according to the second embodiment, audio and/or video signals coded by using a coding method after switched can be sent without connecting a new call, which eliminates a need for complicated communication processes. Thus, the communication efficiency can be improved.

Another Embodiment

A part or all of functions described in each of the

above-described embodiments can be implemented by a control program. In such a case, the control portion within an apparatus described in each or the above-described embodiments uses a control program for implementing a part or all of functions described in each of the above-described embodiments to implement a part or all of functions described in each of the above-described embodiments. In this case, a memory medium for storing the control program may be a floppy disk, a hard disk, an optical disk, a photomagnetic disk, a CD-ROM, a magnetic tape, a non-volatile memory card, or a ROM, for example.

The invention may be embodied in other specific forms without departing from essential characteristics thereof.

For example, in the above-described embodiments, a case has been described where a coding method before switched is a first coding method and a coding method after switched is a second coding method. However, the present invention is limited thereto. It is possible that the coding method before switched is an a^{th} (a = 1 to N) coding method and the coding method after switched is b^{th} (b = 1 to N, $b \neq a$).

Therefore, the above-mentioned embodiments are merely examples in all respects, and must not be construed to limit the invention.

The scope of the present invention is defined by the scope of the appended claims, and is not limited at all by

the specific descriptions of this specification. Furthermore, all the modifications and changes belonging to equivalents of the claims are considered to fall within the scope of the present invention.